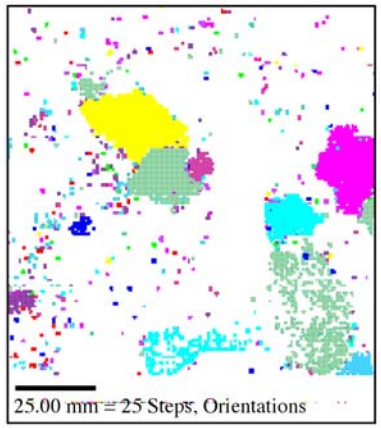
Cooperative Grain Boundary Sliding and Heterogeneities of Grain Boundary Character Distribution in Superplastic Materials

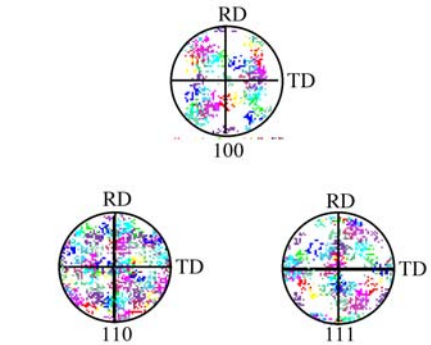
Hamid Garmestani, DMR Award #0109535

Mechanisms of Superplastic Forming

- Orientation Imaging Microscopy of Superplastic 7475 material!
- Major texture components have been identified and analyzed
- Special Grain Boundary Character has been inverstigated and its evolution for different levels of superplastic forming reported
- A non-contact technique to measure displacement gradient has been invented.
- A composite model is introduced which incorporates both SPF and non-SPF phenomena

◆ ◆ ◆





Copper	{112}<111>	(39.2,65.9,26.6)
Copper	{112}<111>	(90.0,35.3,45.0)
S	{123}<634>	(52.9,74.5,33.7)
S	{123}<634>	(59.0,36.7,63.4)
S	{123}<634>	(27.0,57.7,18.4)
S	{123}<634>	(121.0,36.7,26.6)
Brass	{110}<112>	(54.7,90.0,45.0)
Brass	{110}<112>	(35.2,45.0,0.0)
Goss	{110}<001>	(0.0,45.0,0.0)
Shear	{001}<110>	(45.0,0.0,0.0)
Shear	{112}<110>	(0.0,35.0,45.0)
Shear	{111}<110>	(0.0,55.0,45.0)

Deformation texture components identified and shown as the different color codes

"On the independent behavior of grain boundary sliding and intragranular slip during superplasticity", Sheikh-Ali, AD; Garmestani, H., Trans Tech Publications, Materials Science Forum, vol. 357-359, pp. 393-398, 2001.

"A Unified Phenomenological Model for Superplastic Materials", H. Garmestani and F. Booeshaghi, accepted for publication in International Journal of Plasticity.

Cooperative Grain Boundary Sliding and Heterogeneities of Grain Boundary Character Distribution in Superplastic Materials

Hamid Garmestani, DMR Award #0109535

Training

- 3 graduate students in experiments (Gail Jefferson, Samuel Adedokum, Ding Li) have participated in research. Samuel Adedokum will be involved in theory also.
- One undergraduate student (Michelle Adams) has become involved in the OIM experiments and will be involved in the composite formulation.
- Askar Sheikali is the Post-doc research associate on this work in charge of the grain boundary character analysis!
- Two of these students a(Gail Jefferson -graduate student and Michelle Adams -Undergraduate student) areboth African Americans!

Outreach (by graduate student KarenDaniels)

- As part of another NSF program (CIRE), 3 African American students have been trained on the microscopy techniques related to the present research in Superplasticity!